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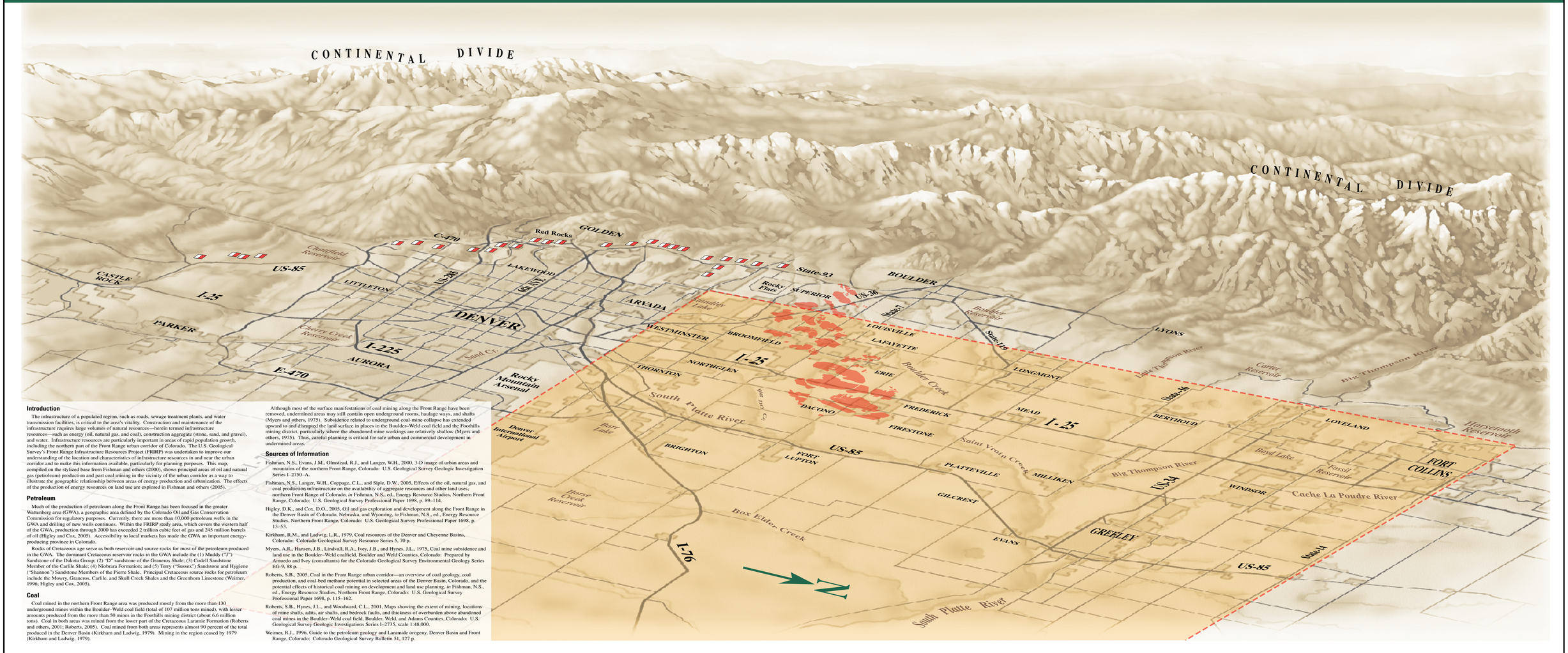

Introduction

The infrastructure of a populated region, such as roads, sewage treatment plants, and water transmission facilities, is critical to the area's vitality. Construction and maintenance of the infrastructure requires large volumes of natural resources—herein termed infrastructure resources—such as energy (oil, natural gas, and coal), construction aggregate (stone, sand, and gravel), and water. Infrastructure resources are particularly important in areas of rapid population growth, including the northern part of the Front Range urban corridor of Colorado. The U.S. Geological Survey's Front Range Infrastructure Resources Project (FRIRP) was undertaken to improve our understanding of the location and characteristics of infrastructure resources in and near the urban corridor and to make this information available, particularly for planning purposes. This map, compiled on the stylized base from Fishman and others (2000), shows principal areas of oil and natural gas (petroleum) production and past coal mining in the vicinity of the urban corridor as a way to illustrate the geographic relationship between areas of energy production and urbanization. The effects of the production of energy resources on land use are explored in Fishman and others (2005).

Petroleum

Much of the production of petroleum along the Front Range has been focused in the greater Wattenberg area (GWA), a geographic area defined by the Colorado Oil and Gas Conservation Commission for regulatory purposes. Currently, there are more than 10,000 petroleum wells in the GWA and drilling of new wells continues. Within the FRIRP study area, which covers the western half of the GWA, production through 2000 has exceeded 2 trillion cubic feet of gas and 245 million barrels of oil (Higley and Cox, 2005). Accessibility to local markets has made the GWA an important energy-producing province in Colorado.

Rocks of Cretaceous age serve as both reservoir and source rocks for most of the petroleum produced in the GWA. The dominant Cretaceous reservoir rocks in the GWA include the (1) Muddy ("J") Sandstone of the Dakota Group; (2) "D" sandstone of the Graneros Shale; (3) Codell Sandstone Member of the Carlile Shale; (4) Niobrara Formation; and (5) Terry ("Sussex") Sandstone and Hygiene ("Shannon") Sandstone Members of the Pierre Shale. Principal Cretaceous source rocks for petroleum include the Mowry, Graneros, Carlile, and Skull Creek Shales and the Greenhorn Limestone (Weimer, 1996; Higley and Cox, 2005).

Coal

Coal mined in the northern Front Range area was produced mostly from the more than 130 underground mines within the Boulder–Weld coal field (total of 107 million tons mined), with lesser amounts produced from the more than 50 mines in the Foothills mining district (about 6.6 million tons). Coal in both areas was mined from the lower part of the Cretaceous Laramie Formation (Roberts and others, 2001; Roberts, 2005). Coal mined from both areas represents almost 90 percent of the total produced in the Denver Basin (Kirkham and Ladwig, 1979). Mining in the region ceased by 1979 (Kirkham and Ladwig, 1979).

Although most of the surface manifestations of coal mining along the Front Range have been removed, undermined areas may still contain open underground rooms, haulage ways, and shafts (Myers and others, 1975). Subsidence related to underground coal-mine collapse has extended upward to and disrupted the land surface in places in the Boulder–Weld coal field and the Foothills mining district, particularly where the abandoned mine workings are relatively shallow (Myers and others, 1975). Thus, careful planning is critical for safe urban and commercial development in undermined areas.

Sources of Information

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Principal Areas of Oil, Natural Gas, and Coal Production in the Northern Part of the Front Range, Colorado

By Neil S. Fishman, Stephen B. Roberts, John M. Evans, and Robert J. Olmstead

2005

Front Range Infrastructure Resources Project

Coal mine location, Foothills mining district

Greater Wattenberg area

Undermined areas, Boulder–Weld coal field

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